

PINEWOOD NEMATODE, BURSAPHELENCHUS LIGNICOLUS,  
A NEMATODE PEST OF SOME PINE SPECIES

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Specimens of the pinewood nematode, Bursaphelenchus lignicolus Mamiya and Kiyohara, 1972, were found infecting Pinus nigra Arn. (Austrian pine) in Boone County, Missouri in 1979. This is the first reported occurrence of this nematode in the United States. Pinewood nematode is reported in Japan to cause a severe problem on Pinus thunbergii Parl. (Japanese black pine). In addition to the United States and Japan, this nematode also occurs in France.

Disease Symptoms and Development

Early visible symptoms of this disease, commonly called the wilting disease of pine trees, appear on needles as a general wilt. As infected trees become more stressed, a yellowing of the needles appears, followed by browning, after which the tree dies.

During disease development there are physiological changes which occur within the infected trees. The first detectable internal symptom to appear is a marked reduction of oleoresin produced by the diseased tree. Oleoresin production by trees inoculated with B. lignicolus ceases within 2 weeks after inoculation. Next, the transpiration of moisture from the leaves is reduced as the disease progresses. The reduction in transpiration occurs 20-30 days after inoculation. Until this stage of disease development, there are no observable external symptoms. However, there is a wilt and gradual yellowing of the foliage following the reduction in transpiration. The wilting and chlorosis are accompanied by a rapid decrease in sapwood moisture content, which contributes toward desiccation of wood. Approximately 50 days after the first internal symptoms, or about a month after the first visual symptoms, the diseased tree dies.

Large numbers of B. lignicolus occur in stems, branches, and roots of infected trees as the disease progresses.

Transmission of Pinewood Nematodes

Studies in Japan show that dauerlarvae (a quiescent stage in development) of Bursaphelenchus lignicolus were recovered from the adults of eight species of beetles within the family Cerambycidae. The nematodes were found most frequently and in greatest numbers in Monochamus alternatus Hope, the Japanese pine sawyer. Adult beetles collected in a severely damaged pine forest contained an average of 15,000 dauerlarvae per insect. Insects become contaminated with the nematode prior to the insects' emergence from infected pine trees. The greatest concentration of nematodes occurs in tracheae directly connected with the metathoracic spiracles of the beetles.

When adult beetles containing B. lignicolus fed upon healthy trees, transmission of the disease occurred in 100% of test trees. Beetles not containing the nematode failed to transmit the disease.

## Pathological Anatomy

Microscopic observations of sectioned material taken from diseased wood revealed Bursaphelenchus lignicolus in axial and radial resin canals. The resin canal parenchyma cells and epithelial cells of infected wood were conspicuously damaged and in many cases were completely destroyed. Nematodes also occurred intracellularly in the epithelial cells, if the cells were not too severely damaged. Evidently, the nematodes infest the resin canals and feed on the epithelial cells. Nematodes appear to move up, down, and across the network of axial and radial resin canals within the wood. This internal damage is observed in wood from dead and nematode-infected older black pine trees and is similar to symptoms found in seedlings inoculated with the nematode.

## Fecundity and Life Cycle of Pinewood Nematode

Bursaphelenchus lignicolus may complete its life cycle in 4-5 days at 25 C. One female may lay as many as 216 eggs, with peak oviposition occurring within 4 days after egg-laying commences. Females die shortly after oviposition ceases; however, the average adult life span of a female is 15 days.

## Control

Most effective control measures are achieved by preventing maturation feeding of the beetle, Monochamus alternatus, on fresh branches of hosts. Applications of a 0.5% emulsion of a phosphatic insecticide such as fenitrothion at the rate of 2-3 pints per tree to the crowns of healthy trees prior to maturation feeding have been used to kill M. alternatus.

Systemic chemicals are being investigated as possible trunk injection or soil application treatments for control of M. alternatus.

## Survey and Detection

- 1) Pine trees of any age which have foliage that rapidly wilts, yellows, and becomes necrotic in a 2-4 week period should be inspected.
- 2) Beetles associated with the diseased tree should be submitted in alcohol for identification and determination of the presence of nematodes.
- 3) Samples of wood from infected trees should be submitted for nematode analysis. Nematodes may be found in stems, main trunk, or roots of infected trees.

## References

- Mamiya, Yasuharu. 1976. Pine wilting disease caused by the pine wood nematode, Bursaphelenchus lignicolus, in Japan. JARQ 10(4):206-211.
- \_\_\_\_\_, and Makota Furukawa. 1977. Fecundity and reproductive rate of Bursaphelenchus lignicolus. Jap. J. Nematol. 7:6-9.
- \_\_\_\_\_, and Tomoya Kiyohara. 1972. Description of Bursaphelenchus n. sp. (Nematoda : Aphelenchoididae) from pine wood and histopathology of nematode-infected trees. Nematologica 18:120-124.